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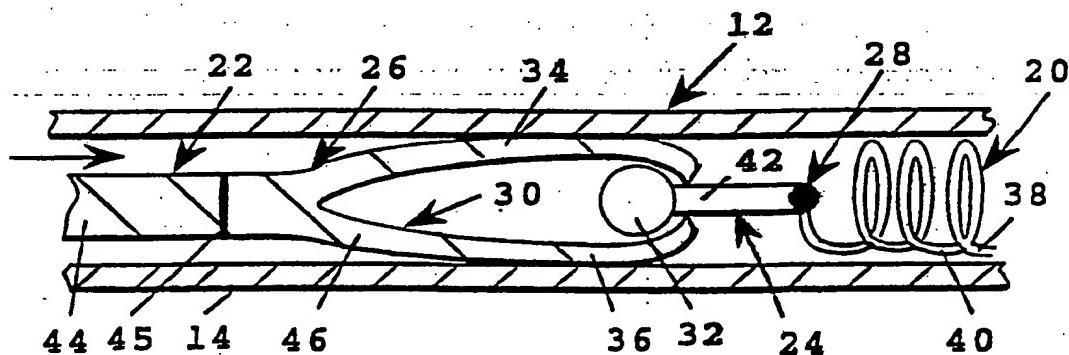
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| (51) International Patent Classification 5 : A61M 29/00 | A1 | (11) International Publication Number: WO 92/21400 (43) International Publication Date: 10 December 1992 (10.12.92) |
| <p>(21) International Application Number: PCT/US92/04661 (22) International Filing Date: 5 June 1992 (05.06.92)</p> <p>(30) Priority data: 712,191 7 June 1991 (07.06.91) US</p> <p>(71)(72) Applicant and Inventor: MARKS, Michael P. [US/US]; 4216 Bettina Avenue, San Mateo, CA 94403 (US).</p> <p>(74) Agent: DEHLINGER, Peter, J.; Law Offices of Peter J. Dehlinger, P.O. Box 60850, Palo Alto, CA 94306-0850 (US).</p> <p>(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), SE (European patent).</p> | | <p>Published With international search report.</p> <p>目的 A(6) 管の内塞</p> <p>大 214.13 明</p> <p>特 徵 取管由意のIP E. 43-7の2-112-9102 保持1, 43-7の2-113-9102 保持2: 開閉可 43-7の2-113-9103</p> |

(54) Title: RETRACTABLE-WIRE CATHETER DEVICE AND METHOD



VHXTL7-277 A7A

(57) Abstract

Apparatus and method for placing a vaso-occlusion wire at a selected site in a vessel. The apparatus includes a catheter (12), and a pusher-and-wire assembly (22) in which a vaso-occlusion wire (20) is held in an axially clamped position until the wire (20) has been advanced beyond the end of the catheter (12). The assembly may be adapted for guiding the catheter to the site, either by flow-directed or wire-directed movement.

IT IS CLAIMED:

1. Apparatus for use in producing vaso-occlusion at a selected site in a body vessel comprising
5 a catheter having proximal and distal ends and an interior lumen extending therebetween, and adapted for placement of its distal end adjacent such selected site,
a vaso-occlusion wire extendable from a relaxed condition capable of assuming a convoluted condition, 10 to an extended, linear condition in which the wire can be advanced through said lumen,
15 a pusher which is controllable from the proximal catheter end to advance said wire, with such in its extended condition, through said catheter by contact between confronting ends of the pusher and wire,
clamping means associated with such confronting ends of said pusher and wire, when the pusher is used to advance the wire through the catheter lumen, for 20 holding the wire in clamped engagement with the pusher, as the wire is advanced through the catheter lumen, and release means in said catheter, adjacent its distal end, for releasing the clamped engagement of the pusher to the wire when a selected portion of the wire 25 has been advanced beyond the distal catheter end.
2. The apparatus of claim 1, wherein said clamping means includes an radial enlargement carried on one of such confronting ends, and expandable jaws associated with the other of such confronting ends for movement between a closed condition produced by contact of the jaws with the catheter lumen, in which the jaws are

effective to hold the radial enlargement in clamped engagement, and an open condition produced by interaction of the jaws with said release means, in which jaws are expanded to release the radial enlargement.

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3. The apparatus of claim 2, wherein said radial enlargement is carried on said wire, and said jaws are associated with said pusher.

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4. The apparatus of claim 1, wherein said clamping means includes an radial enlargement carried on one of such confronting ends, and an expandable coil associated with the other of such confronting ends for expansion between a closed, more coiled condition produced by contact of the coil with the catheter lumen, in which the coil is effective to hold the radial enlargement in clamped engagement, and an open, less coiled condition produced by interaction of the jaws with said release means, in which coil is expanded to release the axial enlargement.

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5. The apparatus of claim 4, wherein said radial enlargement is carried on said wire, and said coil is associated with said pusher.

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6. The apparatus of claim 4, wherein said radial enlargement is carried on said pusher, and said coil is associated with said wire.

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7. The apparatus of claim 1, wherein said release means includes a rim defined by the distal-end of said catheter.

13. The apparatus of claim 12, wherein said wire includes an elongate coil whose opposite ends are connected by a torqueable, substantially inelastic band.

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14. A wire-and-wire assembly for use with a catheter having proximal and distal ends and an interior lumen extending therebetween and which is adapted for placement at a selected vessel site, comprising
10 a vaso-occlusion wire extendable from a relaxed condition capable of assuming a convoluted shape, to an extended, linear condition in which the wire can be advanced through the lumen of such catheter,
15 a pusher which is operable from the proximal catheter end to advance said wire axially, with such in its extended condition, through said catheter by contact between confronting ends of the wire and pusher,
20 an radial enlargement carried on one of such confronting ends, and
expandable structure associated with the other of such confronting ends adapted for movement between a closed condition produced by contact of the jaws with the catheter lumen, in which the structure is effective
25 to hold the radial enlargement in clamped engagement, and an open condition produced by expansion of the structure, in which the enlargement is axially releasable from the structure.

30

15. The assembly of claim 14, wherein said expandable structure includes expandable jaws adapted for movement a relaxed, open condition and a closed condition produced by contact of the jaws with the catheter lumen.

16. The assembly of claim 15, wherein said radial enlargement is carried on said wire, and said jaws are associated with said pusher.

10
15. The assembly of claim 15, wherein said clamping structure includes an expandable coil adapted for expansion between a closed, more coiled condition produced by contact of the coil with the catheter lumen, and an open, less coiled condition, in which coil is expanded to release the radial enlargement.

18. The assembly of claim 17, wherein said radial enlargement is carried on said wire, and said coil is associated with said pusher.

19. The assembly of claim 17, wherein said radial enlargement is carried on said pusher, and said coil is associated with said wire.

25
20. The assembly of claim 14, wherein said wire includes an elongate coil whose opposite ends are connected by a substantially inelastic thread.

21. The assembly of claim 14, for use in guiding a catheter through a branched vessel path by flow-directed movement of the catheter's distal end, wherein said wire includes flexible distal-end structure which, 5 when advanced beyond the distal end of the catheter, is adapted to open to provide increased area of contact with blood flowing in a vessel.
22. The assembly of claim 21, wherein said wire 10 includes an elongate coil whose opposite ends are connected by a substantially inelastic thread.
23. The assembly of claim 14, for use in guiding the catheter through a branched vessel path by wire-directed movement of the catheter's distal end, wherein 15 said wire is torqueable, includes a distal end region which assumes a bent configuration when the end region is advanced beyond the distal end of the catheter, and said clamping means is effective to transmit torque 20 between said pusher and said wire, with such in the catheter lumen.
24. The assembly of claim 23, wherein said wire 25 includes an elongate coil whose opposite ends are connected by a torqueable, substantially inelastic band.

31. The method of claim 30, for use in guiding the catheter through a branched vessel path by flow-directed movement of the catheter's distal end, wherein said wire includes flexible distal-end structure which, 5 when advanced beyond the distal end of the catheter, is adapted to open to provide increased area of contact with blood flowing in a vessel, which further includes the steps of:

(a) advancing the wire distally, to advance said 10 segment beyond the distal end of the catheter, when it is desired to guide the catheter into a vessel branch having greater fluid flow at a branch point, and

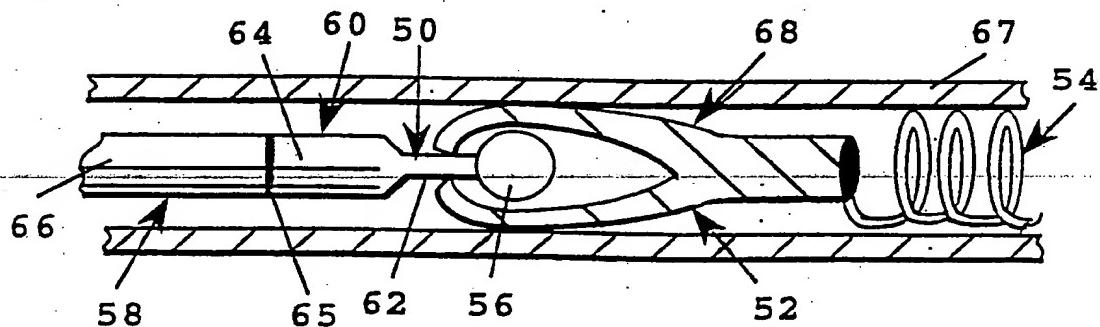
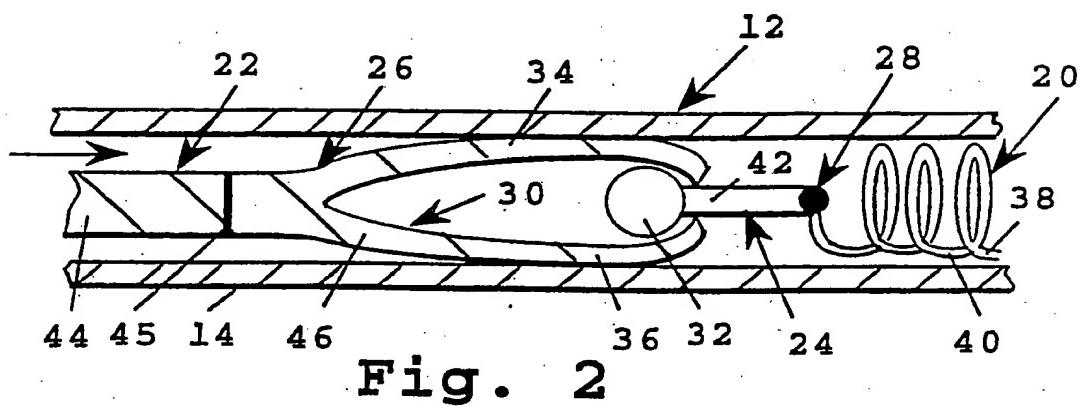
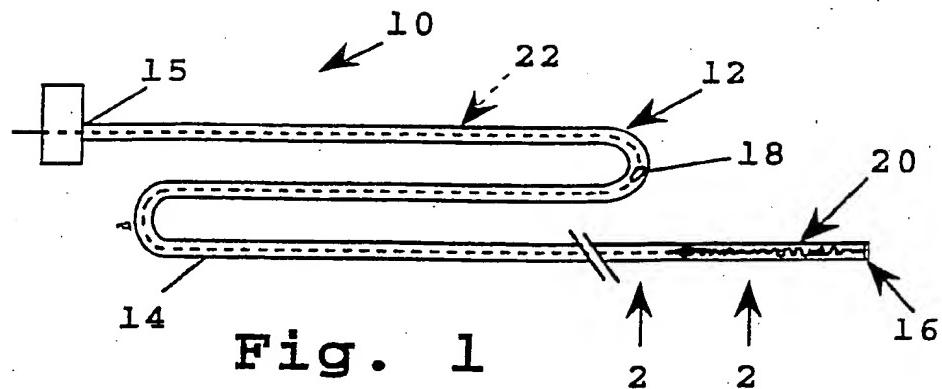
15 (b) retracting the wire proximally, to draw said segment within the distal end of the catheter, when it is desired to guide the catheter away from a vessel branch having greater fluid flow at a branch point.

32. The method of claim 30, for use in guiding the catheter through a branched vessel path by wire-directed movement of the catheter's distal end, wherein 20 said wire includes a distal segment which assumes a bent configuration when the end region is advanced beyond the distal end of the catheter, and said wire can be torqued remotely as it advanced within the 25 catheter, which further includes the steps of:

(a) advancing the wire distally, to advance said segment beyond the distal end of the catheter, when it is desired to guide the catheter into one of two vessels at a vessel branch point;

30 (b) torquing the wire to orient the bent segment of the wire in the direction of the one vessel at the branch point, and

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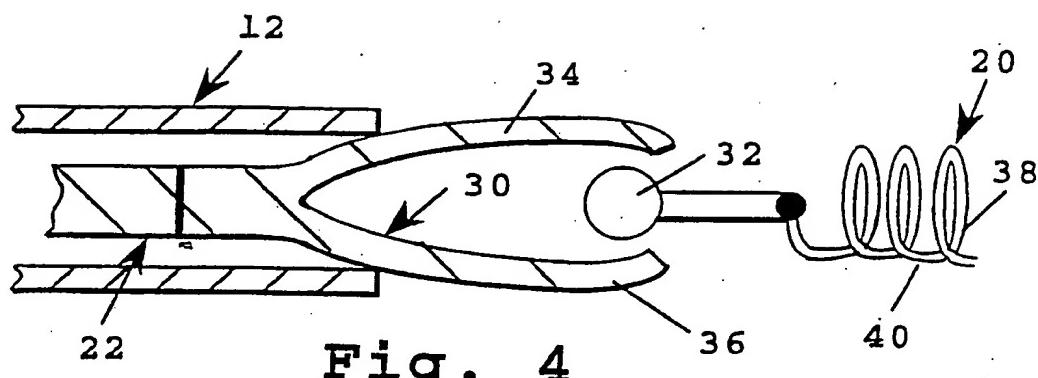


Fig. 4

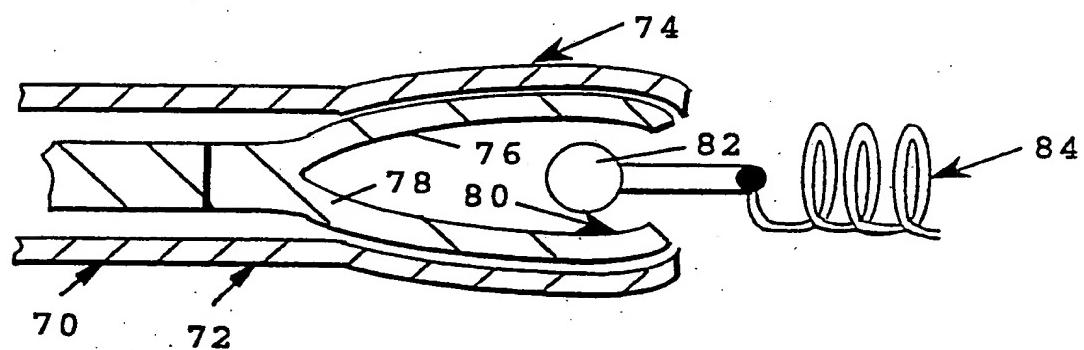


Fig. 5

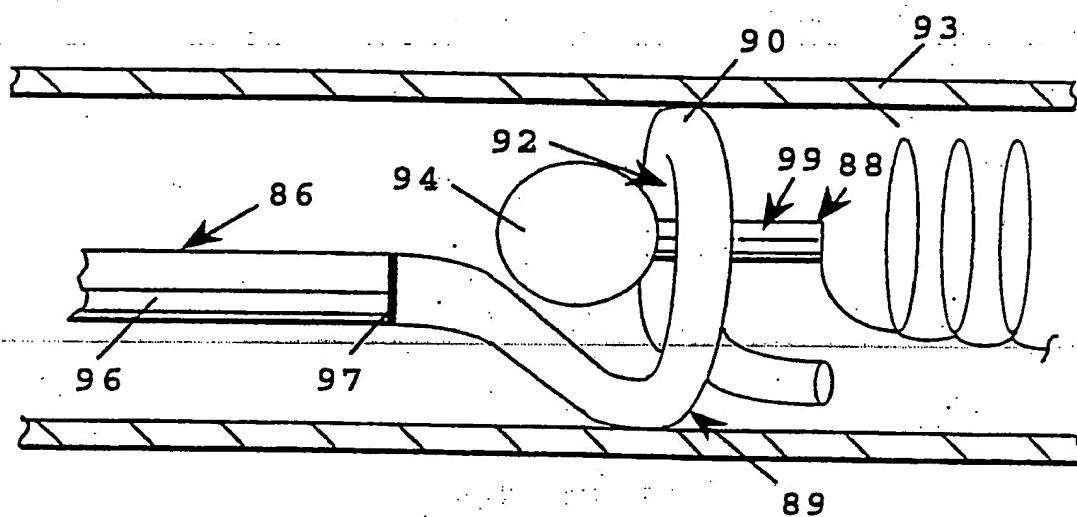


Fig. 6

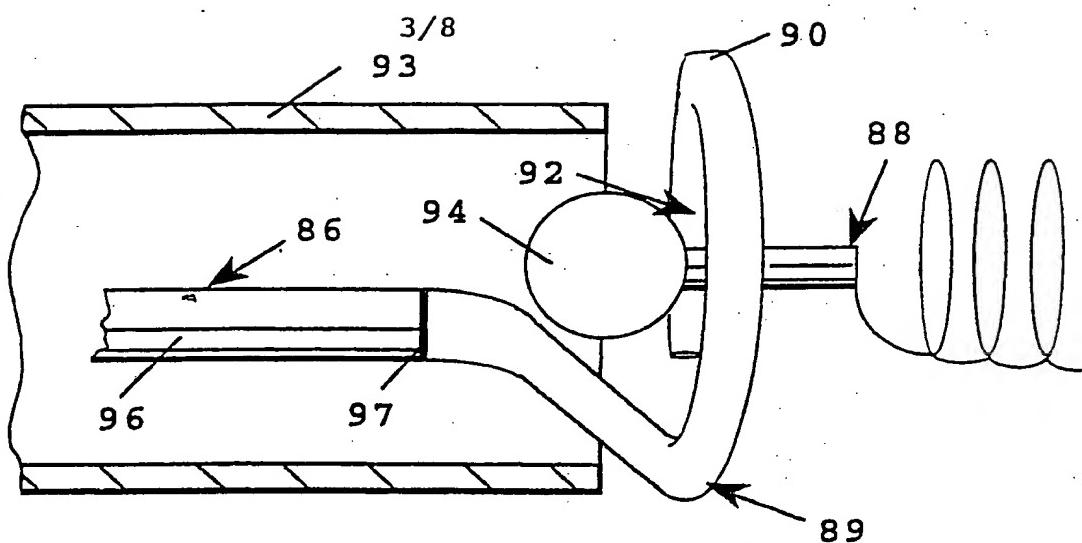


Fig. 7

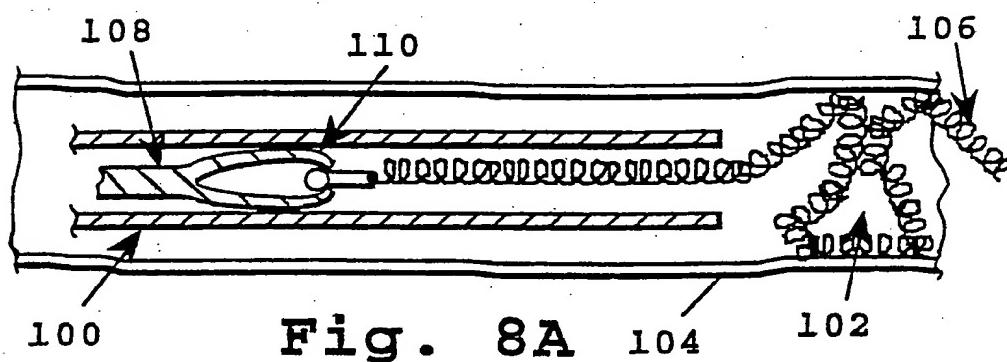


Fig. 8A

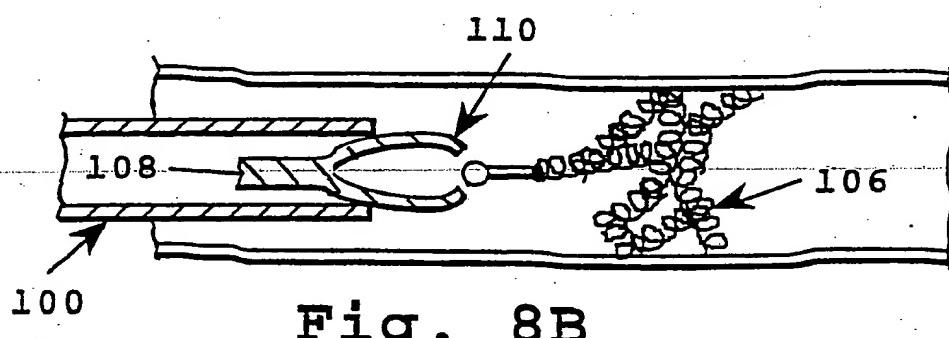


Fig. 8B

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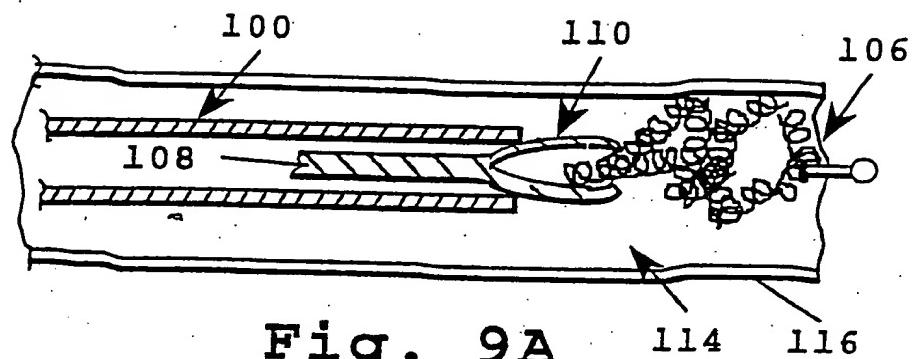


Fig. 9A

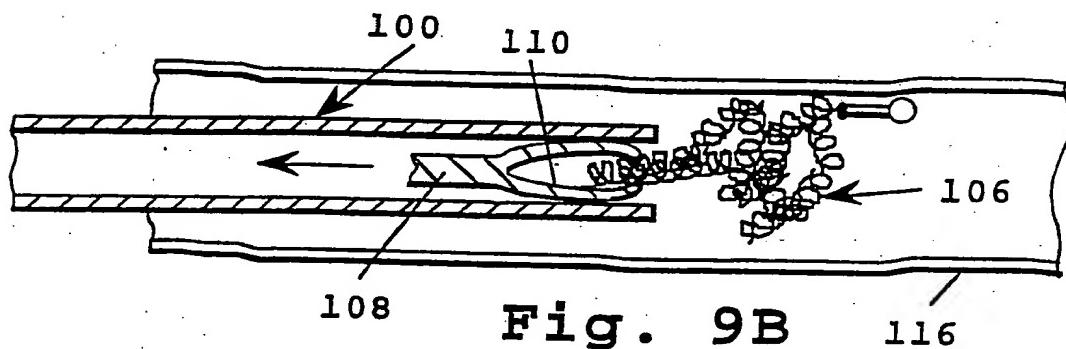


Fig. 9B

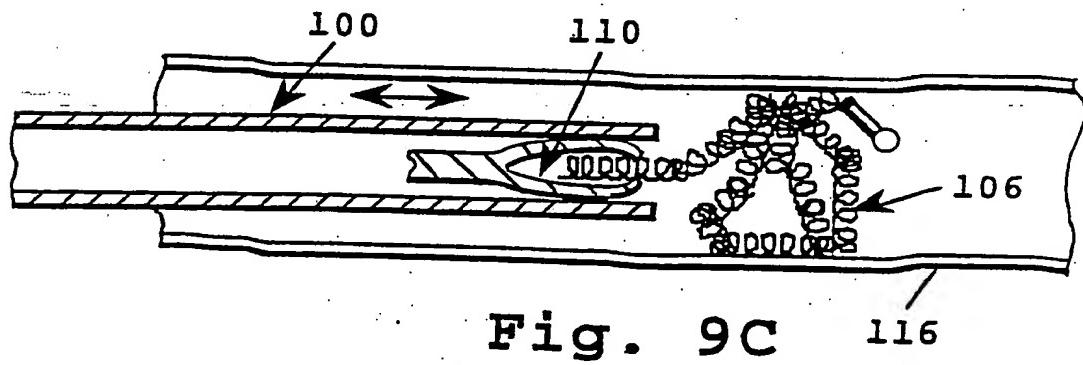


Fig. 9C

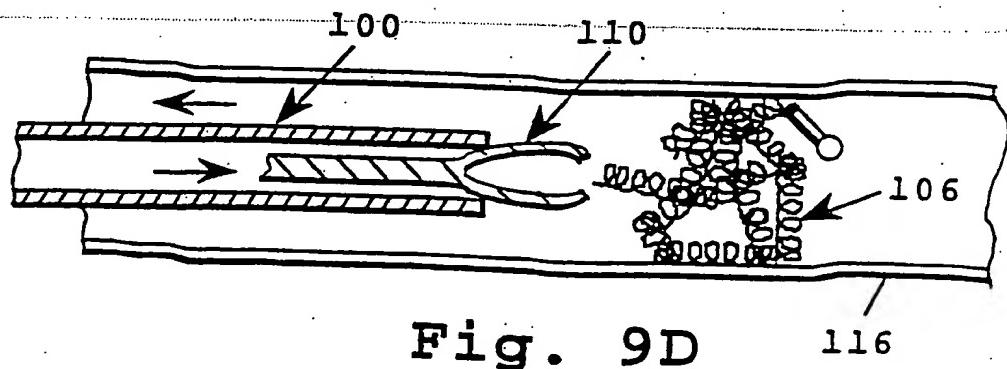


Fig. 9D

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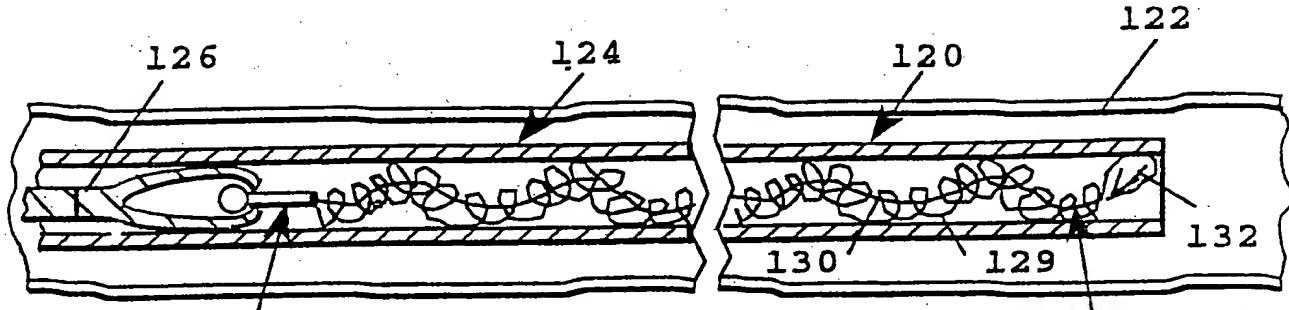


Fig. 10A

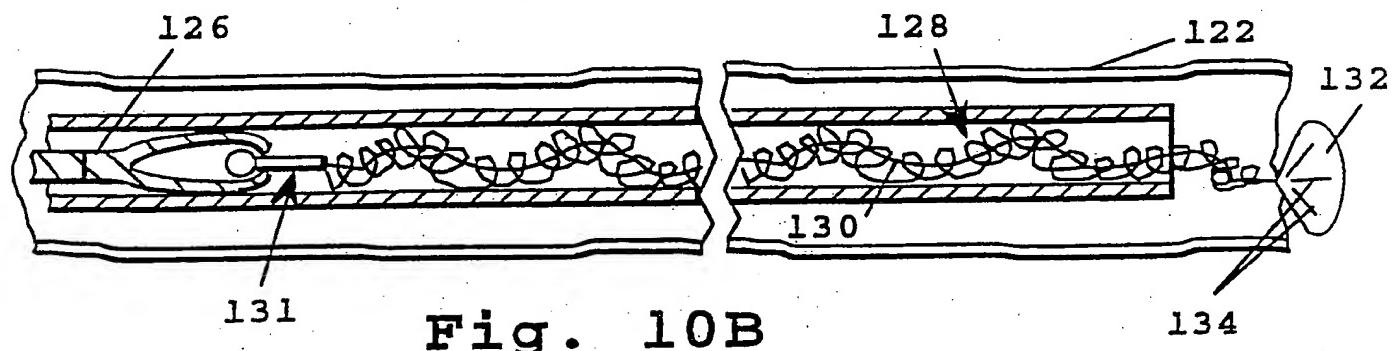


Fig. 10B

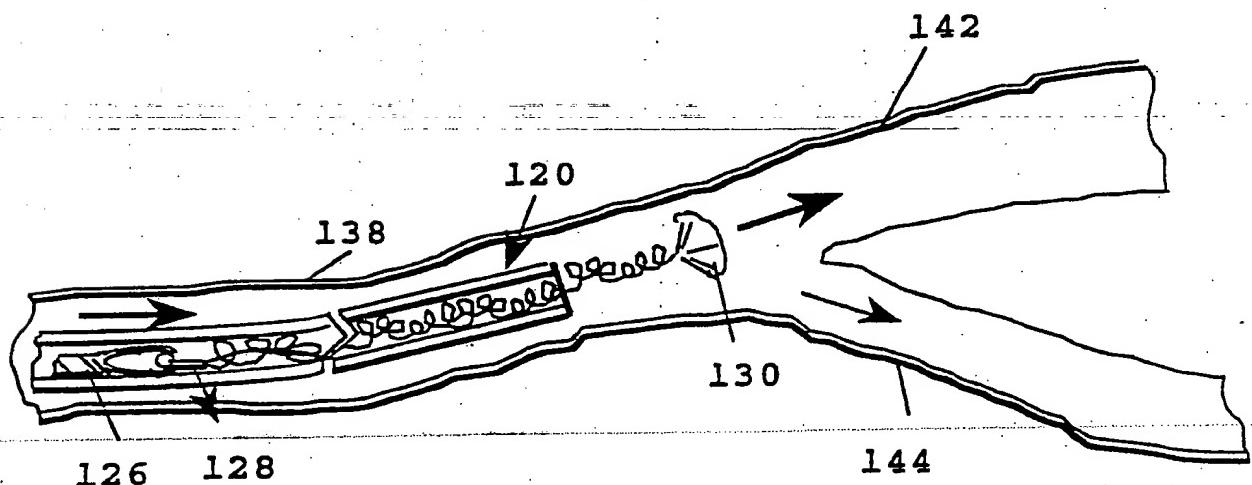
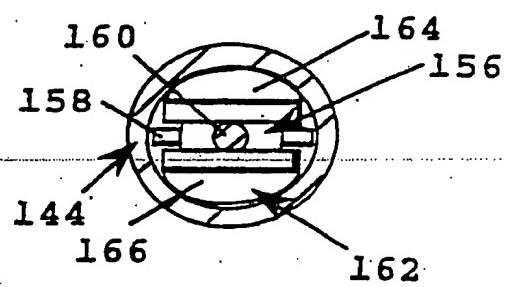
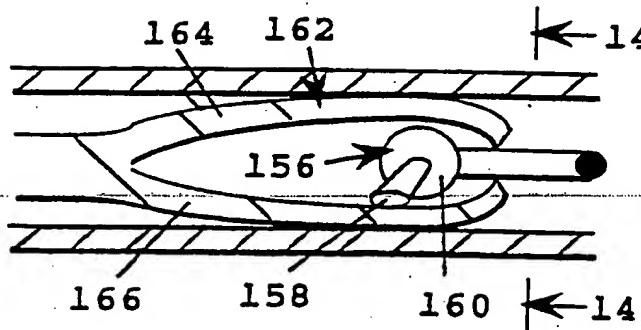
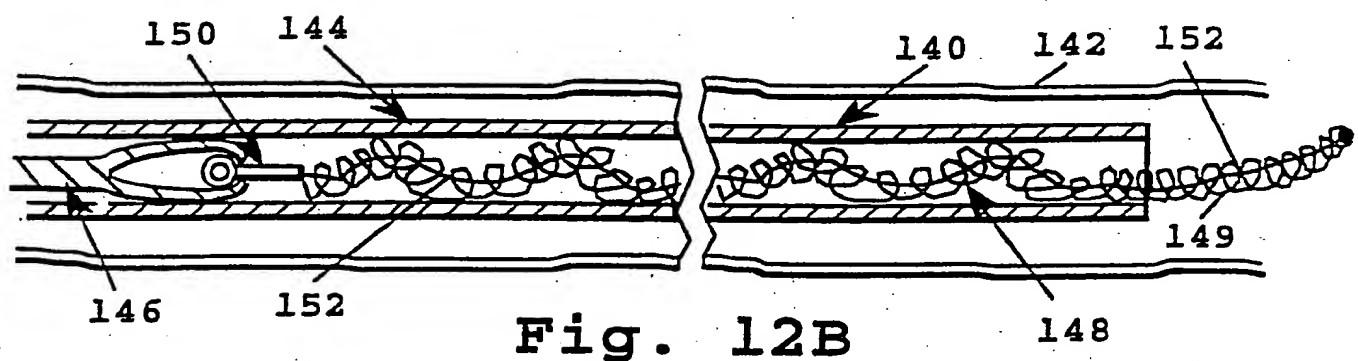
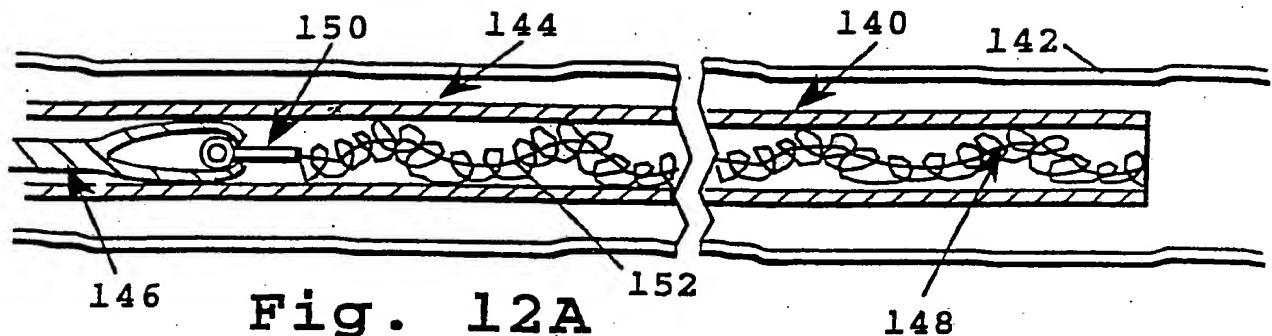


Fig. 11

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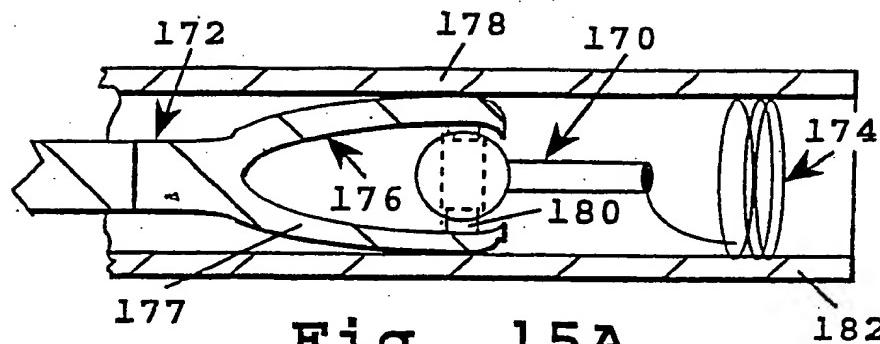


Fig. 15A

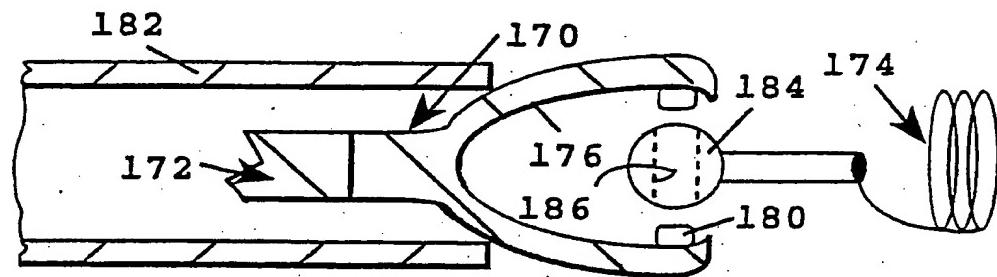


Fig. 15B

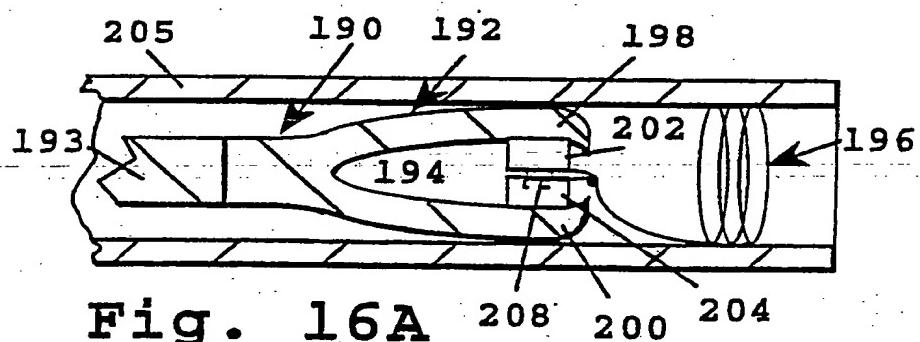


Fig. 16A

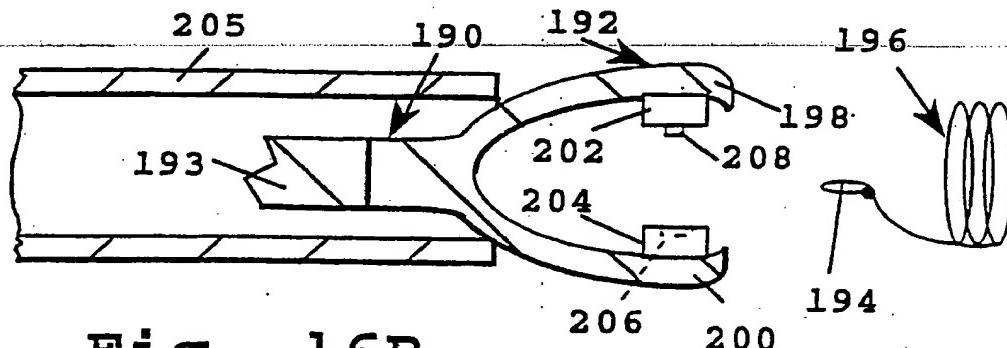


Fig. 16B

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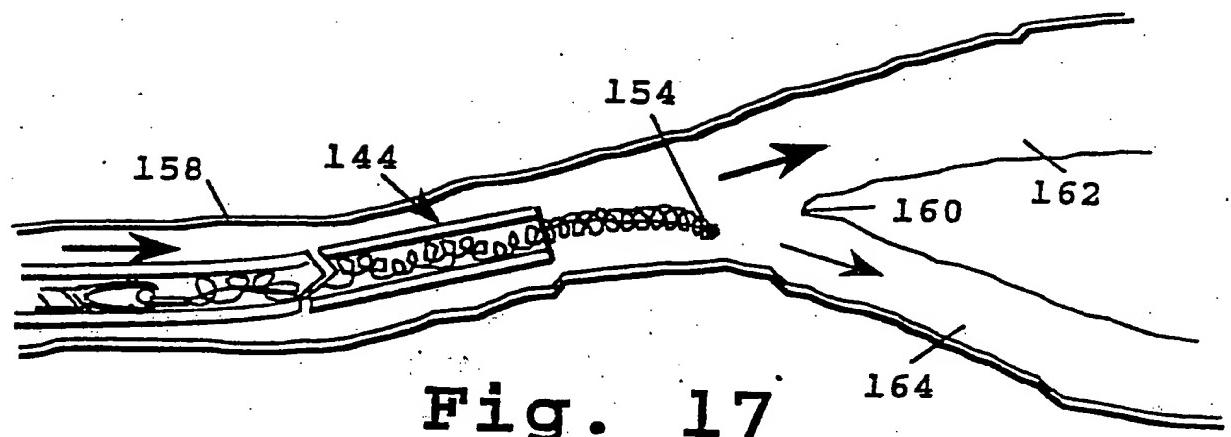


Fig. 17

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